

Oct 3/4 sheet.

$$1. \frac{1 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{M} = 120$$

$$2. \frac{1 \cdot 8 \cdot 7 \cdot 6}{T} = 336$$

$$3. \frac{7 \cdot 6 \cdot 5}{=} = 210$$

4. 3 Boys 6 Girls \rightarrow 9 total

$$\frac{6 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{G} \frac{5}{G}$$

$$5. \frac{2 \cdot 2 \cdot 2}{=} = 8$$

$$6. \frac{9 \cdot 10 \cdot 10}{=} = 900$$

\uparrow
 can't be
 zero

$$7. \frac{26 \cdot 25 \cdot 24 \cdot 23 \cdot 22}{=} = 7,893,600$$

$$8. 6! = 720$$

$$\frac{6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{}$$

9. 4 people

$$\frac{3 \cdot 1 \cdot 2 \cdot 1}{=} = 6 \text{ ways}$$

\uparrow
 charlie

$$10. \frac{5 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 \cdot 2}{=} = 1200$$

\uparrow consonant \uparrow vowel

Factorials

1. $0! = 1$

2. Natural

3a) $\frac{8!}{5!} = 336$

$$\begin{array}{r} * 8 \cdot 7 \cdot 6 \cdot \cancel{5} \cdot \cancel{4} \cdot \cancel{3} \cdot \cancel{2} \cdot \cancel{1} \\ \hline 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 \end{array}$$

b) $\frac{19 \cdot 18 \cdot 17 \cdot 16 \cdot 15 \cdot 14 \cdot \cancel{13!}}{13!}$

$$= 19535040$$

c) $\frac{21 \cdot 20 \cdot 19 \cdot 18 \cdot \cancel{17!}}{4! \cdot \cancel{17!}}$

$$= \frac{143640}{24} = 5985$$

* finish

Q1.3

$$\begin{aligned} \text{1a) } \frac{(n+1)!}{(n+3)!} &= \frac{\cancel{(n+1)} \cdot n \cdot \cancel{(n-1)} \cdots}{(n+3)(n+2)\cancel{(n+1)} \cdot n \cdot \cancel{(n-1)} \cdots} \\ &= \frac{1}{(n+3)(n+2)} \end{aligned}$$

$$\text{b) } \frac{(n+6)!}{(n+5)!} = \frac{\cancel{(n+6)} \cancel{(n+5)!}}{\cancel{(n+5)!}} = (n+6)$$

$$\begin{aligned} \text{c) } \frac{(n+1)!}{(n-1)!} &= \frac{(n+1) \cdot n \cdot \cancel{(n-1)!}}{\cancel{(n-1)!}} \\ &= (n+1) \cdot n \\ &= n^2 + n \end{aligned}$$

$$\begin{aligned} \text{d) } \frac{(n+2)!}{n!} &= \frac{(n+2)(n+1) \cdot \cancel{n!}}{\cancel{n!}} \\ &= (n+2)(n+1) \\ &\text{or } n^2 + 3n + 2 \end{aligned}$$

$$\begin{aligned} \text{e) } \frac{(n-2)!}{n!} &= \frac{\cancel{(n-2)!}}{n \cdot (n-1) \cdot \cancel{(n-2)!}} \\ &= \frac{1}{n(n-1)} \text{ or } \frac{1}{n^2 - n} \end{aligned}$$

$$2a) \frac{(n+5)!}{(n+3)!} = 56$$

$$\Rightarrow \frac{(n+5)(n+4)\cancel{(n+3)!}}{\cancel{(n+3)!}} = 56$$

$$(n+5)(n+4) = 56$$

$$n^2 + 4n + 5n + 20 = 56$$

$$n^2 + 9n - 36 = 0 \quad \rightarrow 20 - 56$$

$$\text{add} \Rightarrow 9$$

$$\text{mult} \Rightarrow -36$$

$$-3 \quad + 12$$

$$(n-3)(n+12) = 0$$

$$n-3=0 \quad \left\{ \begin{array}{l} n+12=0 \\ n=-12 \end{array} \right.$$

$$\boxed{n=3}$$

$$\cancel{n=-12}$$

can't have a negative factorial

$$b) \frac{(n-1)!}{(n-2)!} = 12$$

$$\frac{(n-1)\cancel{(n-2)!}}{\cancel{(n-2)!}} = 12$$

$$n-1=12$$

$$\boxed{n=13}$$

$$c) \frac{(n+2)!}{(n+1)!} = 10$$

$$\frac{(n+2)\cancel{(n+1)!}}{\cancel{(n+1)!}} = 10$$

$$\overset{\curvearrowright}{n+2=10}$$

$$\boxed{n=8}$$

$$2d) \frac{2(n+3)!}{2(n+1)!} = \frac{180}{2}$$

$$\frac{(n+3)!}{(n+1)!} = 90$$

$$\frac{(n+3)(n+2)\cancel{(n+1)!}}{\cancel{(n+1)!}} = 90$$

$$(n+3)(n+2) = 90$$

$$n^2 + 5n + 6 = 90$$

$$n^2 + 5n - 84 = 0$$

$$(n+12)(n-7) = 0$$

$$\cancel{n=-12} \quad \boxed{n=7}$$